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ABSTRACT

The perspectives of researchers, teachers, and students in a research project attempting to implement wait time in high school classrooms were examined. This study investigates, via participant observation, the inner workings of a highly successful research group. Observation, interviews, and surveys were used to study the workings of the research group. Over the course of the study, researchers tended to change their perception of teachers as being dominated by the system and responsive to positive reinforcement, to perceptions of teachers as partners in research and more autonomous decision makers. The researchers maintained a belief in the value of wait time. Teachers felt uncomfortable at first with the Wait Timer and did not become convinced that wait time could be used because of the pressure to cover material at a fast pace. The teachers' were eager to take on a more active role in the research process, despite the severe constraints imposed on their time. Students came to have generally positive views about wait time. The research process became a process of mutual adaptation with less emphasis on the prescription of wait time and more emphasis on dealing with teacher concerns. User uncertainty, resistance, teachers' dilemmas of being at odds with their job description, and questions regarding the relevance of wait time for teaching will need further study. (SLD)

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COMPARING RESEARCHERS', TEACHERS', AND STUDENTS' PERSPECTIVES ON A LINE OF RESEARCH ATTEMPTING TO IMPLEMENT WAIT TIME IN CLASSROOMS

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Introduction

Individuals sharing a particular social status often come to share a common perspective. This investigation explored the perspectives of three different role groups--researchers, teachers, and their students--on a line of research attempting to implement wait time in high school biology and chemistry classes in an NSF funded study. Wait time has been widely recognized as being associated with a variety of desirable learning outcomes, yet is notoriously difficult to implement (Shulman, 1987; Tobin, 1987). How did these researchers view wait time? What role did it have in their vision of "good teaching"? How did they view the teachers they worked with, and how did this influence the research process? How did the teachers and their students view wait time? What constraints in the schools interacted with teachers' beliefs to determine whether they attempted to use wait time? These are questions addressed in this study.

This study investigates, via participant observation, the inner workings of a highly successful research group (in terms of standard criteria of generating publications, presentations, and securing national funding). Data on the teachers' perspective were obtained via interviews with 6 of the 44 teachers, and observations and audio tapes of teacher-researcher interactions over the course of the year. Data on the students' perspectives were obtained via pre and post attitude surveys administered by the researchers, open-ended student reactions to a wait time brochure, and student comments on the retentive effects of participating in a wait time study. The perspectives of the varying role groups are contrasted, and implications for

developing more effective procedures for translating research to practice are drawn.

Related Literature

The idealized version of educational research as a linear process of problem formulation, literature review, design, data collection, analysis, interpretation, and implementation in the schools, has been criticized as being simplistic and unrealistic (Friedman, 1967; Georges, 1980; Tikunoff and Ward, 1983). A top-down approach to implementing research findings, no matter how well validated, has been found to be generally ineffective (Tikunoff and Ward, 1983). Teachers often view researchers' suggestions as irrelevant to their practice, and students' views on a research-based innovation are hardly ever solicited. The research process, and the perspectives of the various participants, are rarely the focus of inquiry (Williams, 1981). In the area of evaluation of educational innovations, Guba and Lincoln (1981), Patton (1980), and others (Crombach, 1980; Lanier and Little, 1986; Miles and Huberman, 1984), have recently emphasized the need to collect data on the program participants' perspectives on the targeted innovation. They emphasize that program evaluation should use multiple methods with the goal of being responsive to participants' questions and concerns.

A number of qualitative researchers have recently pointed to the need to study the research process as a human activity rather than as a set of methodological procedures (Kirk and Miller, 1986; Punch, 1986; Smulyan, 1987). Punch says that "a full history of the research process is an essential element in

reporting a project because of the light it can shed on the nature of the data"(1986, p. 15). Smulyan (1987), in her study of a collaborative action research project, also says there are few studies of how the collaborative process, along with interrelationships between teachers, researchers, and students, affect the resulting research projects and outcomes. Williams (1981), who studied nine naturalistic investigators' research processes, found that "who people are--their motives and their personalities--helps determine how they define their purposes as researchers, how they react to constraints in the research setting, and how they gather and process information" (1981, p. 96). Theoretically, I was guided by a symbolic interactionist framework, which assumes that we actively interpret and define our own reality (Denzin, 1970; Bogdan and Biklen, 1982). I wanted to describe the line of research from the various participants' perspectives, and to describe the development of "shared meanings" among various groups. I came to focus on how the researchers viewed teachers and teaching, and how these views shaped their interactions with their teacher-subjects and their data. In order to more effectively relate the worlds of researchers, teachers, and students, we need to know more about their perspectives regarding a targeted innovation.

Methods

The primary focus of this study was on the researchers' perspectives. Several hundred pages of field notes were collected from October until June (on an average of 10 hours a week observation, though unevenly distributed). These focused on observations of participants in the research laboratory

interacting with teachers, consultants, graduate and undergraduate students, and each other. Several hundred pages of documents including papers and publications, prior staff meeting minutes, and masters' theses coming out of the laboratory, were other data sources. An "intellectual autobiography" documenting the literature I reviewed, and its influence on the methodological decisions I made, was recorded as recommended by Kirk and Miller (1986). Observer comments on field notes, and analytic memos on themes such as "my emerging role in the laboratory" and "researchers' typology of teachers" were recorded. In late May and June, extensive interviews were conducted with the participants in the laboratory, to elicit their histories in the context, the personal meanings the research project held for them, and to test emerging themes. As a participant in the laboratory I joined in staff meetings, conducted discourse analysis of tapes of high school classes, and conducted interviews of teacher-subjects; to better understand the role and impact of this line of research on their practice.

Data on the teachers' perspectives came from informal interviews with six of the teachers who had received wait time training, focusing on the meaning of wait time and its relation to their concept of effective teaching, problems with implementing wait time, and suggestions for the future direction of this line of research. Additional data came from audio tapes and observations of teachers interacting with the researchers over the course of the year in teacher-researcher meetings in the schools, informal interactions in the laboratory, and in a

"Teacher as Researcher" collaboration initiated by the researchers.

Data on the students' perspective came from three sources, representing different methodologies. Pre and post attitude inventories towards various aspects of the classroom environment, and congruence of attitudes towards self, subject, and classroom were collected by the researchers to examine changes over the course of the study. A graduate student, also a teacher researcher, who collected qualitative data on students' perceptions of wait time six years after being involved in a wait time study, made his data available. A class of students' responses to an open ended questionnaire targeted at eliciting their reactions to a wait time brochure was also made available. Findings from these diverse sources were compared and synthesized to describe the students' perspectives.

Data were coded according to the approach delineated by Bogdan and Biklen (1982) and a category system was developed. Emerging themes regarding the nature of the collaborative process, the roles played by the various participants and meanings attached to the research, a typology of how the researchers described their teacher-subjects, how teachers and students perceived wait time, and how these shaped the research directions and outcomes were developed. Propositions were developed around themes, listed on note cards, sorted and reorganized. I then reread the complete set of field notes seeking to verify or refine, and document them.

Results and Discussion

The Researchers' Perspective

Wait time. A shared perception among the five researchers (Tom, Nathan, Pat, James, and Bob) was that wait time is a means of facilitating true discussion, more student thinking and participation. Tom, a co-director of the project, emphasized that there is a lot of research documenting the beneficial effects of wait time for students, e.g. longer student answers, higher level questions, more student involvement, and higher achievement. However in his interview, he conveyed that it is difficult to get teachers to use wait time. In his interview, James commented, "I see wait time as a skill learning process, and the Wait Timer as a device to help teachers learn the concept. I think Pat and Nate have a larger picture of the whole thing, a broader view, with a commitment to the use of wait time. I like to say, hey, look at the data, think about it." Pat explained that their belief in wait time grows out of their values clarification background, and her training with Carl Rogers. Clarifying her view, she commented "I don't have a strong commitment to wait time. I do have a strong commitment to teachers paying attention to kids."

In my interview with Nathan, a co-director of the project, I asked him if he felt that wait time increased teacher stress, a concern Shulman (1987) had raised. He said he felt wait time introduces a positive stress, "its anticipation. The stress that occurs in a fast paced class is the nervous ulcer type of stress. With wait time, the teacher gets to think on her feet, rather than go from correct answer to correct answer. Its more

interactive." He went on to discuss their study. "We are still trying to understand our data set. People really have trouble watching their wait time. We know that when they're really careful about it, tremendous changes occur. And we just can't get them to do it." He discusses his perception of the reason. "They're so pressured by the content, and the driving force of such an idiotic curriculum that doesn't give the teachers any freedom, as they perceive it anyway." Nate says he hopes the Teachers as Researchers program they have initiated, where groups of teachers are conducting their own research studies on problems they selected, will get teachers to work together and become change agents in the schools.

Bob, the data analyst, raised several interesting questions about wait time and the data set. He often asked, "Is wait time a dependent, rather than an independent variable?" James would respond, "We know the Wait Timer is an independent variable." Bob asked, "Why don't Wait Timers produce changes in wait time? We know that in biology a one second increase in wait time is associated with a four point higher Regents score. Increasing wait time by two seconds will do the same in chemistry." Bob speculates that teaching may be a right brain activity. He says, "We're still not sure if group discussion produces academic outcomes." Despite these questions and concerns, when I asked Bob where he felt the line of research should next proceed, he said he would like to try implementing wait time at the elementary school level, where there is a less rigid structure. He also mentioned the idea of training

students to use wait time, as students are "incredibly effective at conditioning their teachers."

Problems in teaching. A number of themes regarding problems in the teaching of high school science resurfaced through out the year. Three of the most pervasive ones in the researchers' conversations were:

(1) the outdated knowledge base of the teachers in the sample. The researchers were very concerned about the number of content errors they heard on the tapes.

(2) the isolation teachers felt from peers, and,

(3) the teachers' primary perception of their role as disseminators of information at a fast pace, to prepare their students to succeed on the New York State Regents Examinations.

Researchers' typology of teachers. The researchers spent hundreds of hours listening to tapes of high school biology and chemistry classes, and occasionally discussed individual teachers they worked with. These teachers and comments about them are discussed below:

The Auctioneer: This was the most frequently discussed teacher in the sample, and also probably the worst teacher (lowest Regents Examination Scores). This teacher's content knowledge was poor, and his instructional skills evidenced problems. He generally talked at a fast pace (they also called him "speedy"), and the students had their own sessions in the back of the room to try to make sense of what was going on. I asked the group if he really was an auctioneer. "No, we don't know anything about him," Pat replied. "An auctioneer would at least acknowledge a bid," James commented.

The Kindergarten-like Teacher: This teacher also drew some attention during the data analysis phase. She tended to talk down to her students, constantly referring to them as "people" and using the term, "moley-go-rounds" for the moles concept, for example.

The Relevance or Content Teacher: One teacher's tapes were very atypical and difficult to analyze. In fact, after repeated attempts the group decided to not use discourse analyses or wait times on her tapes. She had been added to the sample as a replacement teacher for one of the 44 teachers who had dropped out. At first, she turned in tapes of students talking while doing experiments rather than having discussions. After the team intervened, she began turning in taped discussions, but not related to course content. They were largely opinion discussions, e.g. "How do you feel about abortion?" She could not seem to focus both on content and discussion.

Frank: Frank was a teacher who had more treatment than any other teacher. He received a Wait Timer, supportive intervention, a participant-observation study on target students, and is now a teacher researcher. He had a typical pattern of first refusing to participate in a study, and then not wanting to be left out. The group enjoyed him immensely.

Al and Tony: Al and Tony are partners who teach in the same middle school. They were involved in the original middle school study (Swift & Gooding, 1983), and have been working with Wait Timers and on wait time together since 1980. Al was on sabbatical for a semester in the laboratory and is often

introduced as "the world's most experienced user of the Wait Timer." He is highly respected, and thoroughly enjoyed by the group. He has experimented with using the Wait Timer in various ways (as a motivator, in classroom management, and to promote thinking and control interaction). He hopes to remain involved with the group in the coming years.

John and Hugo: These are two of the "best teachers" in the present sample. I interviewed each of them. Like Al and Tony in the middle school study, these two high school teachers collaborate frequently. Their classrooms are across the hall from one another, they interact frequently, and teach each other's classes occasionally. When I was scheduling a meeting with them, Hugo had asked to meet Fridays after school so that it wouldn't interfere with their time with students or planning time. "That's just like them," Nate commented. "They're darn nice."

These are comments regarding teachers who were most frequently discussed in the laboratory. As can be seen from the nature of the comments, teachers at the extremes of a best-to-worst continuum, or atypical teachers were discussed rather than typical teachers. For some reason, anomylaties seem to have a higher salience in the conversations of the researchers. Perhaps, in trying to implement change it is easier to see what factors are involved in a clear success or a clear failure. The partnerships the researchers have observed in the successful teachers have been built into the current Teachers as Researchers program. Can we generalize to the needs of typical teachers by focusing on extremes in our thinking about teachers?

The relation of research to practice. The researchers' perceptions of teachers seemed to shift over the course of the study, from a view of teachers as subjects to be shaped by a humanistic-behavioristic form of supportive intervention, to a more autonomous conception of teacher as decision maker. They have gone from a highly quantitative, linear design, to a more interactive, staff development approach in a new initiative involving teachers as researchers on their own practice-related problems. The implications of this shift are that the research becomes more interactive, a process of "mutual adaptation" which acknowledges and builds on teachers' practical knowledge in translating research to the classroom.

View of a teacher who was a researcher in the laboratory. As a transition to the section focusing on the teachers' perspective, I will discuss the views of Mary, a teacher who became a graduate assistant in the laboratory for a year. In essence she represented all three role groups studied in the present investigation. She commented that sometimes she was unsure which role she was playing. Mary saw herself as both a researcher and a representative of teachers. When asked to describe her views on the wait time study, she said the teachers in the wait time study responded positively to getting together and learning in the content workshops. She commented, "the goal of waiting three seconds, void of all that is just one variable, one more thing researchers tell me I should be doing." Mary advocated staff development, rather than staff training. She felt this validated teachers, rather than training them to be

performers. Regarding wait time, Mary said, "teachers get frustrated with the waiting. They've been doing what they're doing for a long time, and we run a fine line of saying they're not doing it well. Teachers in general, have been having that happen to them a lot." Mary felt the strength of the wait time study was that it was always for the benefit of teachers. She said, "I think there was a lot of integrity there, that was what we were about, and what we wanted to be about. I never got frustrated that people thought teachers weren't worth it. And that carried a lot of weight in the public schools." About her role, she said, "I didn't have any question that I was representing research that was ultimately for the benefit of students. That was the real strength of it."

The Teachers' Perspective

Wait time. As part of my participation in the laboratory, Pat M.(a graduate assistant), Al, and I interviewed teachers who were subjects in the study. Prior to the interviews we met with the research team and formulated and categorized interview questions for eliciting their perceptions on wait time, and the role of research in practice. Sample questions included, "How important is the concept of thinking time in your class?", "Could you describe the process of learning to use a Wait Timer?", and "Would you be interested in becoming a teacher researcher?". We interviewed six of the 11 teachers who received both a Wait Timer and supportive intervention, about their views on wait time. Interviews were taped, partially transcribed, and listened to and coded by the three interviewers, and common themes were described. Several perspectives were shared among

the teachers. Using a Wait Timer was uncomfortable at first, as are most changes. Teachers reported that the Timer was distracting to the students at first, who thought more about the light than their answers to questions. However both teachers and students adjusted to the change.

The teachers were not convinced that wait time was worth integrating into their teaching behavior, nor did they attempt to do so. They were willing to try out wait time in the six taped lessons "for the sake of the experiment," but did not attempt to routinely pause for three seconds. One teacher commented, "I never used the Wait Timer when I wasn't taping. I wonder how they would have been when I wasn't taping?"

Though teachers did not attempt to implement three second pauses as a part of their teaching, they did report that participation in the experiment made them more aware to not interrupt students and to get students not to "blurt out answers." They encouraged students to think about their answers before they responded. Teachers reported that the concept of wait time had "situational relevance," e.g. in review discussions or after higher level questions. One teacher commented that wait time was most useful in discussing ideas after students had been presented with basic information, to move students to higher level cognitive answers. Teachers commented that it's silly to wait after some questions.

Problems in teaching. Teachers felt that using wait time put them at odds with their perceived job definition of "covering the content". A negative aspect of using wait time was that teachers

felt it slowed them down and that they already felt under the gun to cover content. One teacher compared his wait time class with the period before, saying he covered more in his non-wait time class, and felt he was cheating those in the wait time condition. One of their best teachers commented:

> I do try to pack a lot in. For example at the end of the class I feel that its more important to rush through material so the kids are able to do some homework and struggle with it rather than do no homework at all. At least they have exposure to it. I find myself doing that very often. We have a schedule. We know pretty much when each unit will end. If we don't follow that, give or take, you know, a couple of days, we don't get through the material in the year. I do feel that there is too much in teaching chemistry, and I go too fast and that the kids are pushed too much and they're not really getting as much out of it as they would if I had time to stand back and lets say, make a lot more connections. You know, what good is all this? I don't really feel I do that. I think that's bad, but I feel that I have stress upon me that forces me to do that. It's either slow down and not get through the material or go rapidly and maybe not have as productive a teaching session. I think that's the direction I move in. The wait time I think slows me down. You know I hope these three seconds would pass. Does anyone else convey that at all?

Perhaps teachers in non-Regents courses, or at lower grade

levels with less rigid constraints, might be more willing to try implementing wait time.

View of researchers. Regarding working with the research team, all the teachers we spoke to expressed enjoyment of the process. Teachers commented that they liked to talk to the researchers. They felt the research team was very encouraging and supportive. Al summed up the feeling most explicitly, saying the reason he was involved with the research team was because he liked contact with the people involved. The teachers I spoke to said they would like to continue involvement with the group as teacher researchers, if they could focus on some aspect of their instruction that would benefit students. They were not convinced that wait time was such an aspect. Teachers suggested forming content area peer support groups. One teacher suggested researchers focus on daily problems that impact on their teaching, e.g. providing bulbs for their microscopes, and enough frogs to dissect. Teachers were concerned about the time commitment involved in research.

The teachers' comments regarding the enjoyment of the interactions with the researchers, paralleled comments made by the researchers, and my own observations. Teachers felt isolated, and loved to talk to educators who would listen to them. I listened to a tape of one of the researcher-teacher meetings, and the researchers very much played the role of active listeners, allowing teachers to touch upon all kinds of concerns (e.g. scheduling problems, getting the worst classes, the struggles of new teachers). They moved gradually to talk

about wait time, but continued to explore teacher digressions from that topic as they arose. The meeting, as is typical, went beyond the expected time, because of the teachers.

View of research in the practice of teaching. Eighteen teachers are currently involved in the Teachers as Researchers program. Eleven of them were involved in earlier studies with the researchers. Each teacher is working with a group of teachers and research consultants on a study of their own design. Teachers selected the following areas for investigation--improving students' study skills, improving student attitudes towards science, improving student problem-solving, and describing the perceptions of various role groups on shortened science periods.

Recently the teachers, who are five months into their studies, responded to a survey asking them to (1) describe their role as a teacher researcher, (2) list benefits, problems and suggestions for improving the experience, (3) describe what they saw as the future of the program, and (4) indicate whether they were interested in continuing as teacher researchers.

Teachers saw their role as applying learning theory in the classroom, using research to solve problems in practice, and acting as a liaison between the university and the school. Benefits they described were improving their practice, contact with other teachers working on the same problems, and greater understanding of research. One teacher commented he got "a feeling of accomplishment in that I, as a teacher, need to know that what I do in the classroom is important enough for a research project."

The number one problem teachers cited was lack of time. One teacher commented, "I found there is little time for communication and problem solving. Perhaps a conference day or two could be devoted to the project." Al commented, "after being back in school it seems that all of my time is taken up--correcting papers--looking for and designing science activities, and then there's my family." Many suggested spending more than two and a half days in the summer to organize the studies, and incorporating some released time for the research.

Teachers saw the future of the project as contributing to stronger links between the schools and the university. One teacher commented, "teachers have dedicated their professional lives to working with students. The university has the opportunity for long term studies with teachers." Another teacher commented, "I hope teachers can expand the idea to other teachers and students. I've tried to get my students to approach problems as researchers." Teachers were overwhelmingly eager to continue as teacher researchers. The research team is currently seeking grant funding to support such future collaboration.

The Students' Perspective

Attitude towards science. The researchers administered an attitude scale to the students of the 44 teachers at the beginning and end of the year. Regardless of whether the class was biology or chemistry, and regardless of whether there was a Wait Timer and/or supportive intervention in the class, student attitudes towards science became more negative over the course of the year (Gooding, Schell, Swift, J. N., McCroskery, & Swift, P.

R., 1987). In biology classes, there was a very low perception of divergent thinking at the end of the year. In chemistry, there was a low perception of logical reasoning. Students expected to drill on facts, as preparation for the Regents examinations.

Wait time. Data on student perceptions regarding wait time came from two sources. First, Al, a teacher who spent a sabbatical leave in the laboratory, completed a Masters' thesis on the retentive effects of wait time (Conklin, 1987). This was a follow up study to examine the retrospective opinions of high school seniors relative to their participation in a wait time study in middle school, six years earlier. Students were administered a survey with both Likert-type and open-ended questions regarding their wait time experiences. Analysis of the questionnaire indicated that students reported the Wait Timer (1) had helped students listen more carefully (12%), (2) gave students a chance to think (62%), (3) helped the teacher listen more carefully (52%), (4) improved discipline and level of respect for others (23%), and (5) made class discussion more productive.

Negative perceptions of the Wait Timer included comments that the machine was distracting (37%). Twenty-one percent commented that the Wait Timer made them nervous or self-conscious. Ten percent of the students commented that the Wait Timer made the teacher upset (Conklin, 1987). In general, students reacted positively to the concept of wait time, citing many of the same reasons researchers use to support its use.

The second source of data on student views on wait time involved presenting a group of 105 middle school students with a

manual describing the concept of thinking time, research on wait time, and information about the Wait Timer. Students in this group had never experienced using a Wait Timer, though their teacher had used one, as a participant in an earlier study. Students were asked to respond to the questions, "What do you think about what you have just read? Give us your gut feeling and opinions", and "Can you think of other ways this device could be used in your classroom?". Students' responses were sorted into five categories: (1) positive towards wait time (73%), (2) negative toward wait time (8%), (3) uncertain (11%), (4) no opinion (7%), and (5) misunderstood the concept of wait time (2%). A typical response was, "All kids, I think, feel like they are pressured to answer right away, but they have to get it right or they'll look stupid or dumb in front of the teacher. The Wait Timer is a good idea because we need time to put together an answer in our brain and make it accurate." Students told stories of teachers who constantly interrupted them and never paused at all. Many felt the timer would help them respect others' right to talk.

Both sources of data indicate that the students' perspective, despite their daily contact with their teachers, was more closely aligned with that of the researchers. One possible limitation of conclusions from this data is that both teachers involved in the data collection were strongly committed to the use of wait time, and this bias may have been detected by students. The wait time manual was written to emphasize the benefits of wait time, and students may have been responding to

what they thought researchers wanted to hear. Future investigations of the students' perspectives will need to use more neutral stimuli and investigators.

Summary

Different methods of data collection were used to gain information on the perspectives of researchers, teachers and students towards aspects of research on wait time. Unanswered is the question of to what degree the method of data collection shaped the portrait of the different groups' perspectives.

The researchers' perspective was most intensively studied using participant-observation and interview techniques over the course of a year. The researchers seemed to undergo a paradigm shift during the study, from a view of teachers as "driven by the Regents" and subjects to be shaped via "supportive intervention," towards a view of teachers as more autonomous decision makers and essential collaborators in the research process. The researchers maintained a belief in the value of wait time. They still evidenced pervasive concerns regarding the fast pace of classroom recitations, as did teachers. The fluidity of perceptions shifting over time was most apparent with the process oriented methodology used to investigate the researchers' perspective. Yet the question of how educational researchers in other contexts view the teachers they work with is left unanswered. What institutional constraints restrict or facilitate the translation of research to practice in other settings? How do teacher and researcher views interact and shape one another in other research projects? These questions will need to be explored in future investigations.

The teachers' perspective was studied via interactions with the teachers, listening to tape recordings of teacher-researcher meetings, teacher interviews, and a survey on their views towards the Teachers as Researchers program. Process and change was also somewhat revealed in the data on the teachers' perspective, as they shifted in their relationship with researchers from subjects to active collaborators. Regarding wait time, teachers reported they felt uncomfortable at first with using the Wait Timer to attempt to sustain three second pauses. The timer was distracting to their students. Teachers were not convinced that wait time was worth integrating into their teaching, nor did they attempt to do so. They were willing to try out wait time in the six taped lessons "for the sake of the experiment," but did not routinely attempt to pause for three seconds. Teachers reported that the concept had "situational relevance," e.g. in review discussions or after high level questions. They did not use wait time because they felt pressured to cover content at a fast pace. Teachers reported that they very much enjoyed working with the researchers, whom they felt were very encouraging and supportive. They indicated they would like to work with them in the future as teacher researchers.

Data on the students' perspective used several snapshot approaches which revealed aspects of their views at particular points in time. The students' perspective was more closely aligned with the researchers' perspective, despite their daily contact with their teachers. The students attitudes towards science became more negative as the year progressed, and they

came to expect more drill on facts. When told that the typical teacher pauses only a fraction of a second, these students disagreed and told stories of teachers who constantly interrupted them and never paused at all. Students who had participated in the wait time study six years earlier reported that this experience had been beneficial in helping them to "not interrupt others," and "respect other students' right to talk." Students reacting to the wait time manual reported very positive perceptions towards the concept of wait time.

Juxtaposition of participants views yields both commonalties which may serve as the basis for collaboration, and differences which provoke us to reinterpret and modify our conceptions about wait time and how to implement it in classrooms. User uncertainty, resistance, dilemmas of being at odds with their job description, and questions regarding the relevance of wait time for their teaching will continue to be addressed. Is wait time implementable? Can one develop a "situationally relevant" definition of wait time (based on a view of teacher as decision maker) rather than an operational definition of appropriate wait time as a three second pause (based on a prescriptive, rule-based view of intervention)? Is wait time a dependent variable? Is it the pause that makes the difference? Does wait time waste time? Is implementation of wait time adding to the uncertainties already faced by teachers, a question raised by Shulman (1987)?

Several tensions in the research process surfaced frequently over the course of the year. As these tensions were played out, new directions in the research process, with changes in researchers' and teachers' roles, and potential impact for

student outcomes, emerged. The commitment to a collaborative interaction with their teacher-subjects, as opposed to the conviction that a particular intervention in teacher training was necessary, was one such dilemma faced by the researchers. Over the year, the group shifted from a linear, prescriptive research model which attempted to implement wait time in classrooms, to a more interactive, collaborative model which sought to deal with teachers' concerns. Their perceptions shifted towards a more active view of teachers as professional decision makers. Teachers were eager to take on a more active role in the research process, despite the severe constraints imposed on their time. When supported in researching problems they had generated, directly related to their practice, teachers were willing to take on the challenge of a new role. Relationships between the teachers and researchers shifted, with implications for changes in teacher-student relationships. For example some teachers reported they were already trying to get their students to "think like researchers." The implications of this shift are that the research process becomes messier, a process of "mutual adaptation" which acknowledges and builds on teachers' professional knowledge, hopefully while continuing to incorporate the students' perspective into the process. For as Mary, who was a teacher-researcher-student in the laboratory, put it "I never doubted that what we were doing was ultimately for the benefit of students. That is what we were all about, and what we wanted to be about."

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